Dairy and weight management: a review of the evidence

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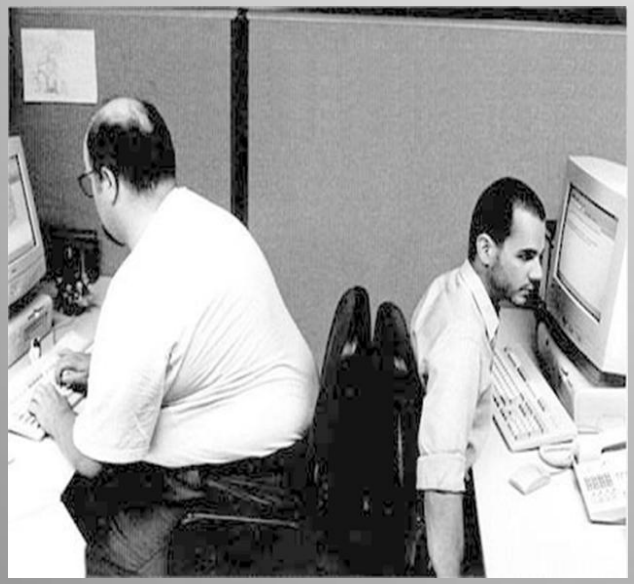
Program

- Dairy and body weight
  - Observational data
  - Randomized controlled trials
- Mechanims linking dairy to energy balance and body composition
- Dairy and type 2 diabetes and CVD

Dairy and body weight



Hierarchy in Scientific Evidence

Systematic Reviews (Meta-analysis)

Randomized Controlled Trials

Other Controlled Trials

Prospective Cohort studies

Case – Control studies

Prevalence studies

Ecological studies

Animal studies

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- Dairy and type 2 diabetes and CVD

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Changes in Diet and Lifestyle and Long-Term Weight Gain in Women and Men

Dariush Mozaffarian, M.D., Dr.P.H., Tao Hao, M.P.H., Eric B. Rimm, Sc.D., Walter C. Willett, M.D., Dr.P.H., and Frank B. Hu, M.D., Ph.D.

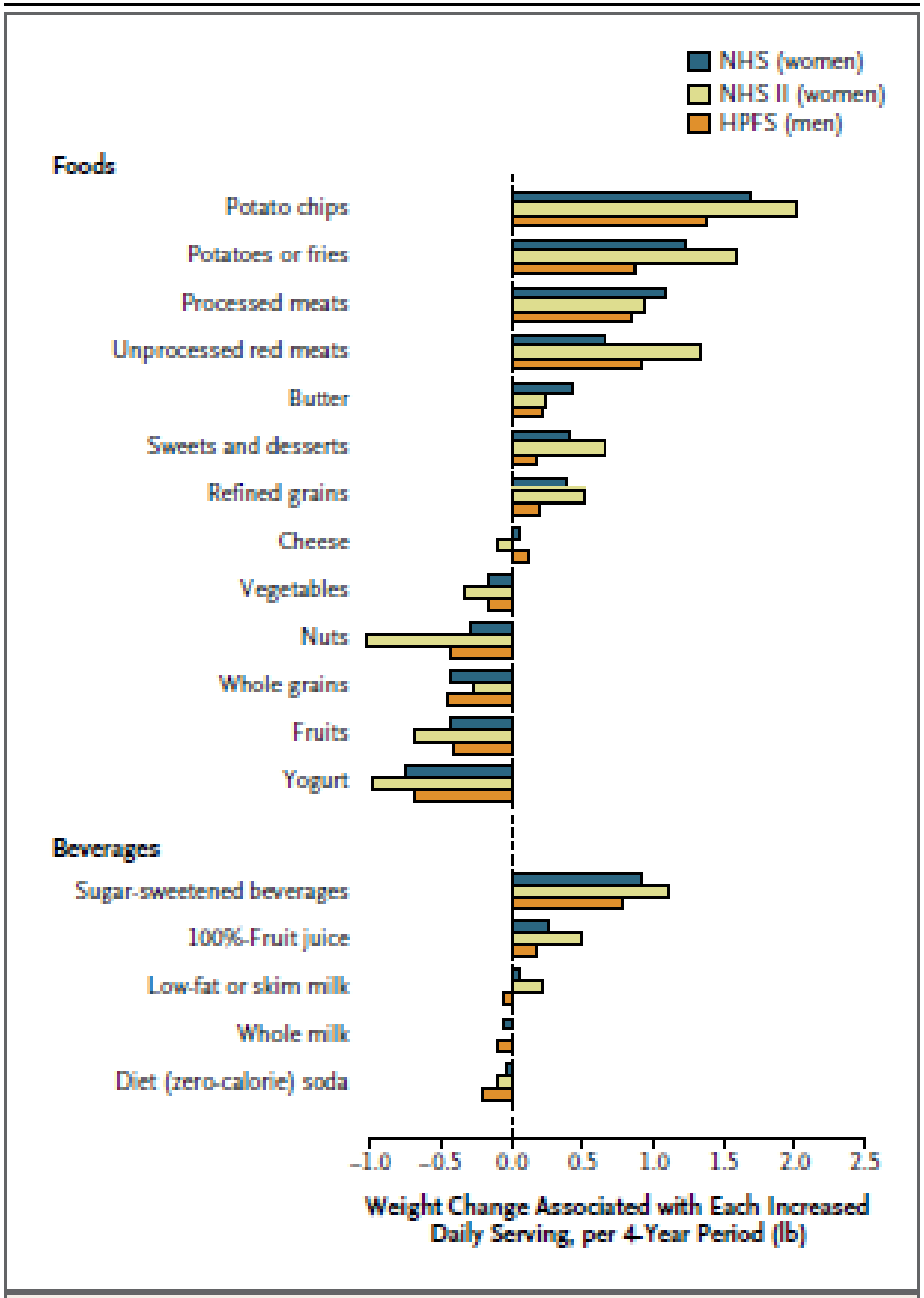

Figure 1. Relationships between Changes in Food and Beverage Consumption and Weight Changes Every 4 Years, According to Study Cohort.

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Product	Serve size	kJ/100g	kJ/serve	Protein/100g	Protein/serve
Whole milk	**250ml**	**293**	**732.5**	**3.5g**	**8.75**
Low-fat strawberry yogurt	**200g**	**341**	**682**	**5.4g**	**10.8**
Cheddar cheese (regular-fat)	**40g**	**1663**	**665**	**24.6g**	**9.8**
Total			**2,080kJ**		**29.4g**

The Diogenes project

A pan-European programme targeting the obesity problem

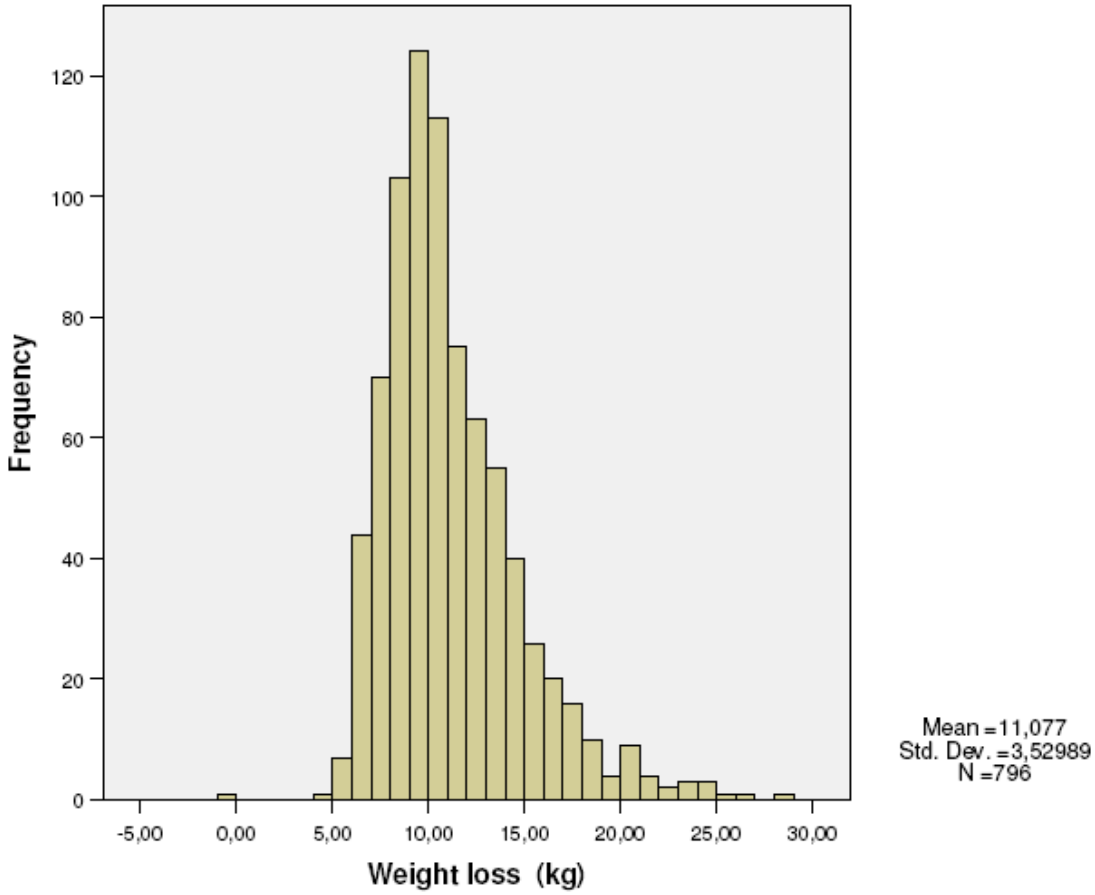
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Diets with High or Low Protein Content and Glycemic Index for Weight-Loss Maintenance

Thomas Meinert Larsen, Ph.D., Stine-Mathilde Dalskov, M.Sc., Marleen van Baak, Ph.D., Susan A. Jebb, Ph.D., Angeliki Papadaki, Ph.D., Andreas F.H. Pfeiffer, M.D., J. Alfredo Martinez, Ph.D., Teodora Handjieva-Darlenska, M.D., Ph.D., Marie Kunešová, M.D., Ph.D., Mats Pihlsgård, Ph.D., Steen Stender, M.D., Ph.D., Claus Holst, Ph.D., Wim H.M. Saris, M.D., Ph.D., and Arne Astrup, M.D., Dr.Med.Sc., for the Diet, Obesity, and Genes (Diogenes) Project

Weight loss on 8 week LCD



Role of *ad libitum* diet composition in prevention of weight gain

- Glycemic Index

- Protein content

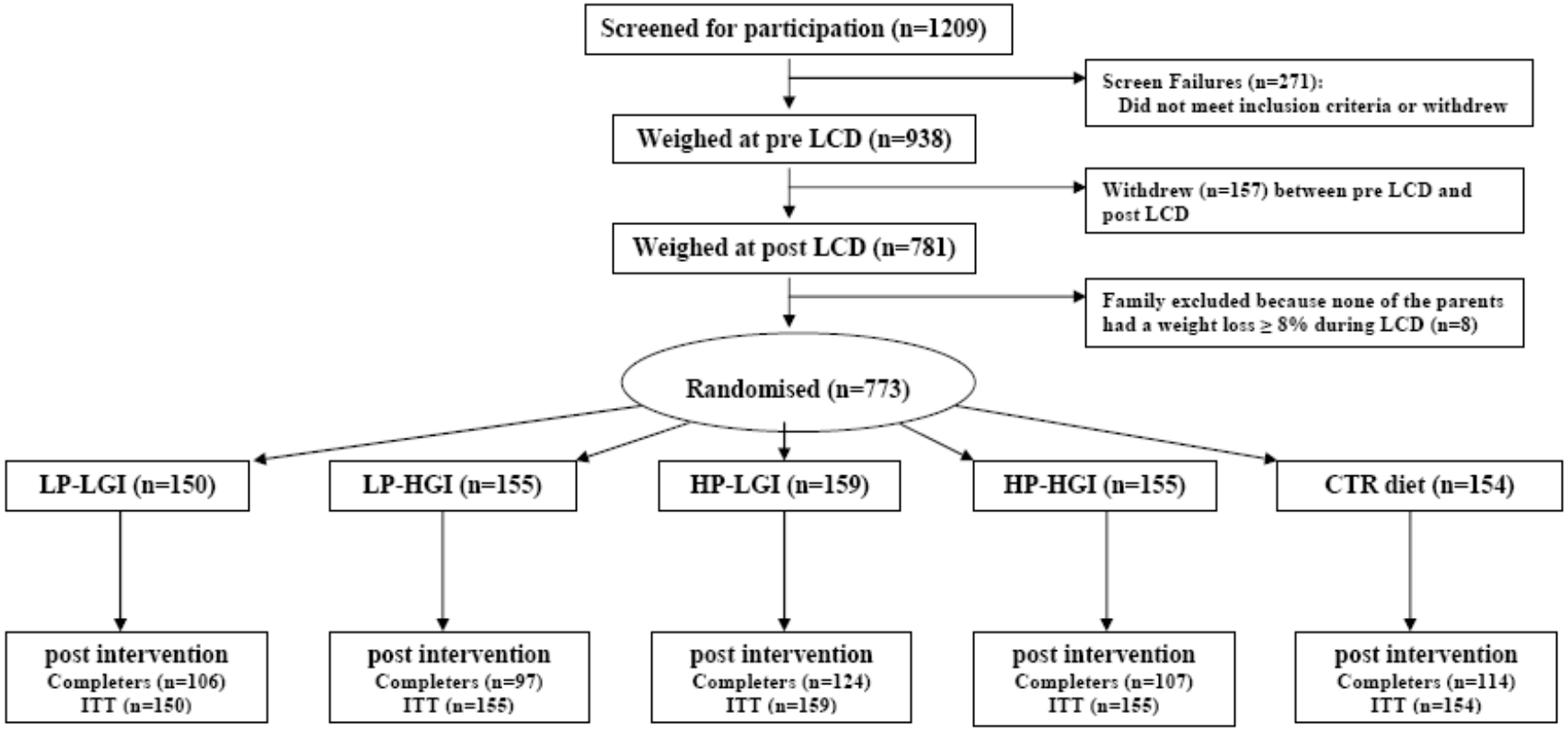
Diet Composition

Group	Fat	Protein	Carbo-Hydrates	Glycemic Index
1 (LP, low GI)	27 (25-30%)	13 (10-15%)	60 (57-62%)	Low
2 (LP, high GI)	27 (25-30%)	13 (10-15%)	60 (57-62%)	High
3 (HP, low GI)	27 (25-30%)	25 (23-28%)	48 (45-50%)	Low
4 (HP, high GI)	27 (25-30%)	25 (23-28%)	48 (45-50%)	High
5 Control	~25 %	~ 15 %	~ 60 %	Medium

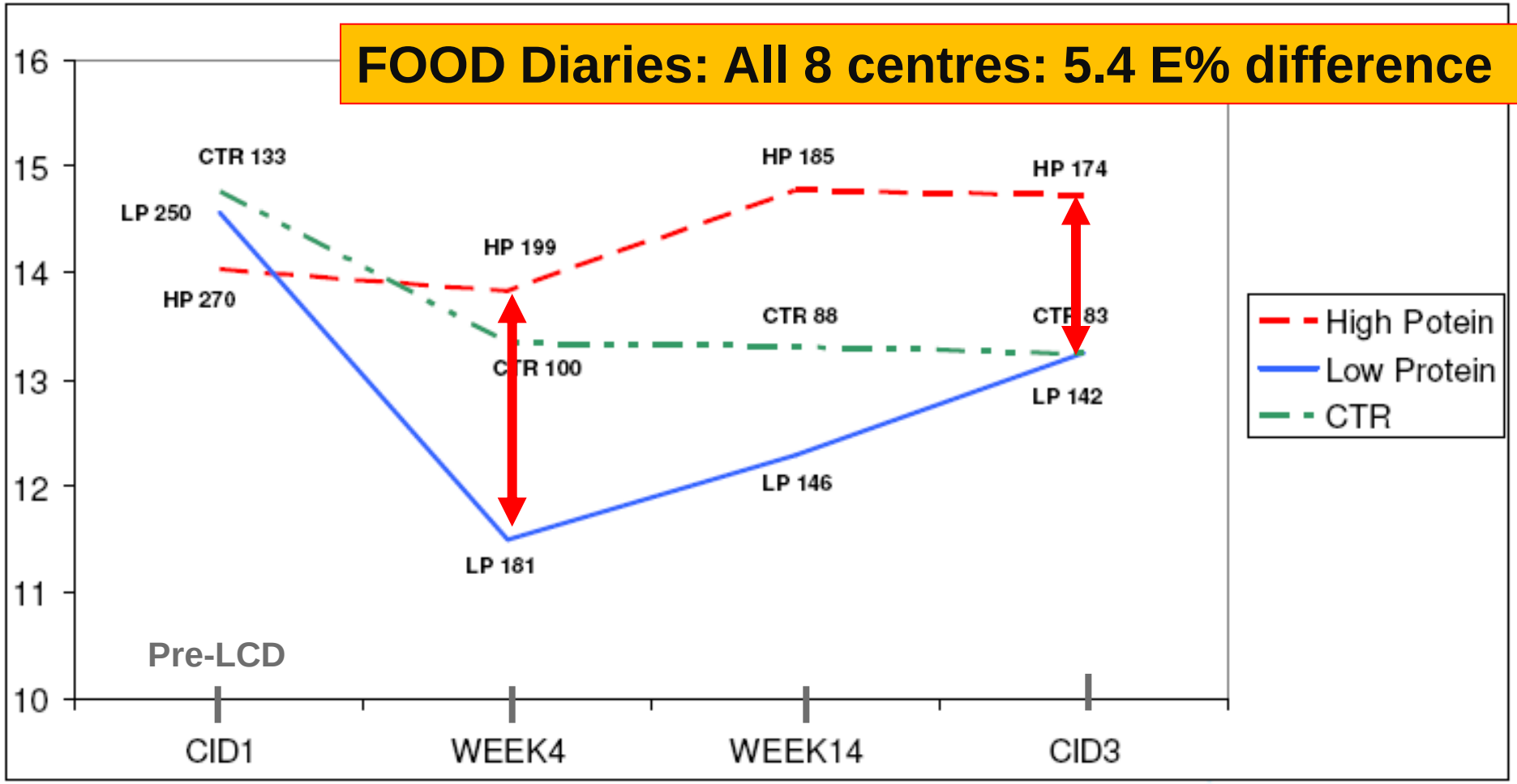

Diogenes

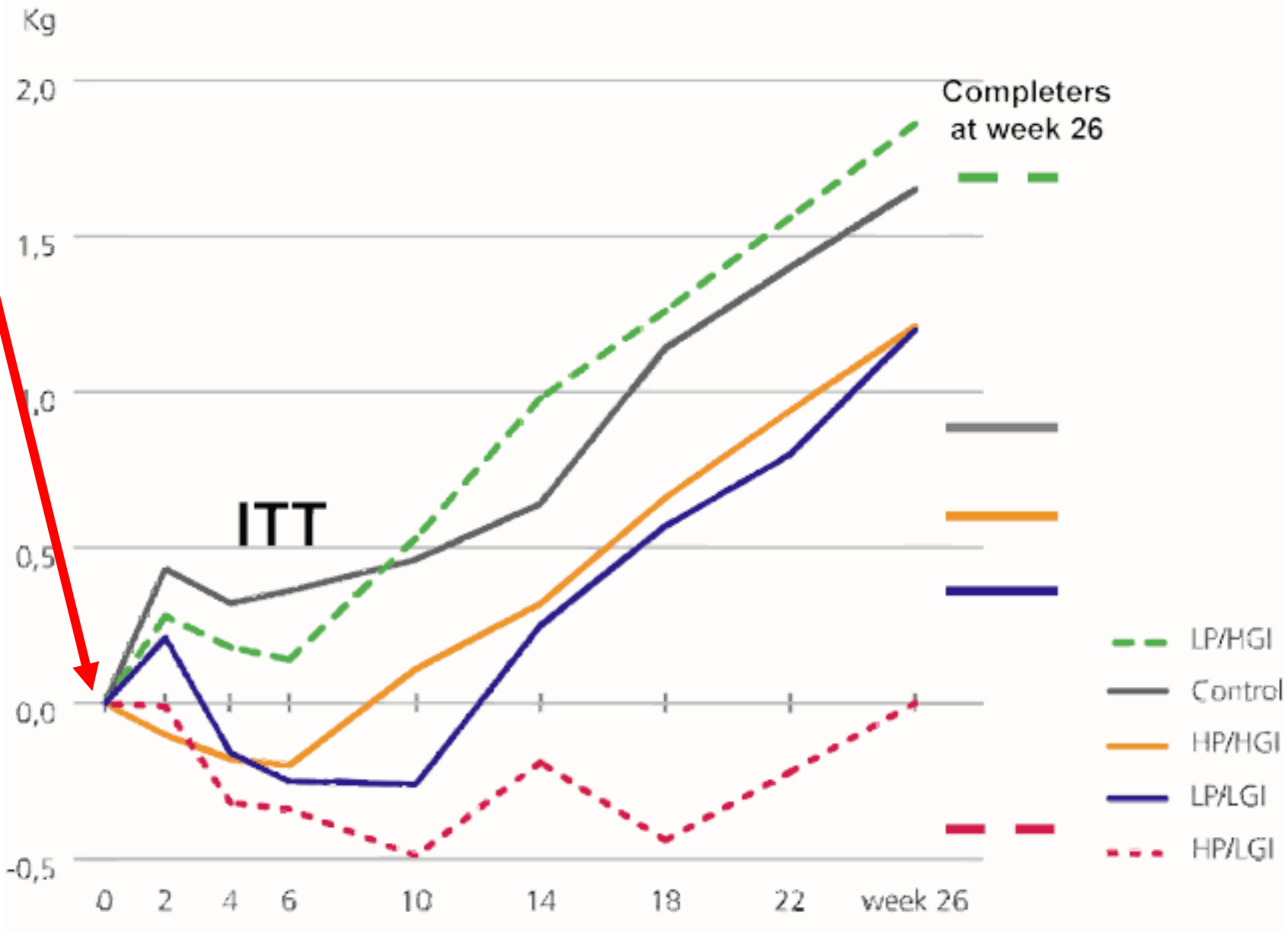
Patient flow

Figure 2, Supplementary Material. **Organization chart of participant flow through the study.**



Compliance to dietary protein intake as assessed by 24 hour urinary nitrogen excretion





Larsen TM et al NEJM 2010

Major end-point: Drop-out rate

Table 2. Drop-out rate during dietary intervention period

	Drop out/Randomised (%)
LP/LGI	44/150 (29.33)[ab]
LP/HGI	58/155 (37.42)[b]
HP/LGI	35/159 (22.01)[a]
HP/HGI	48/155 (30.97)[ab]
CTR	40/154 (25.97)[ab]
Overall	225/773 (29.11)

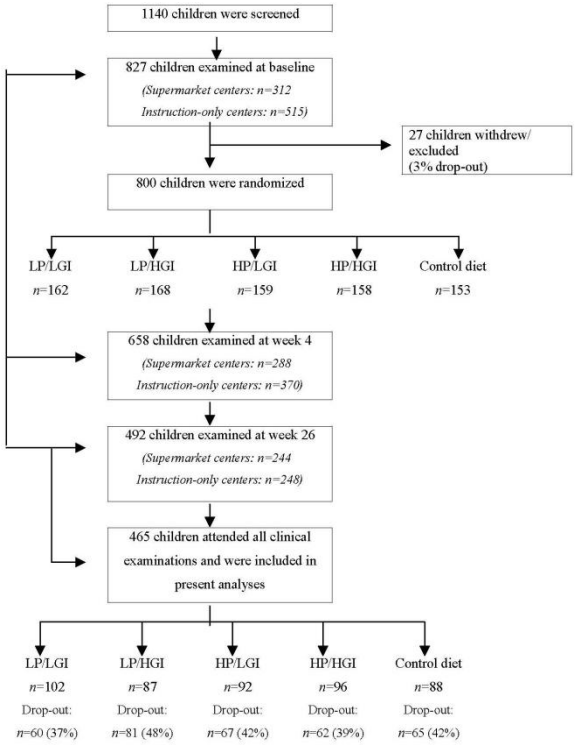
Spontaneous reduction in prevalence of overweight among children

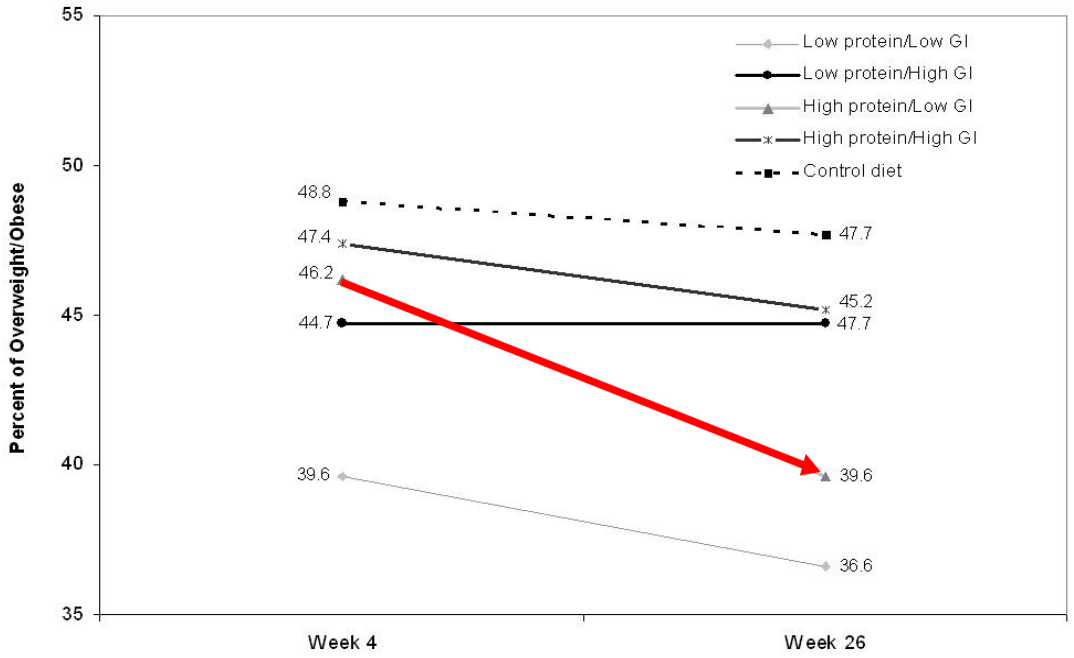
PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

The Effect of Protein and Glycemic Index on Children's Body Composition: The DiOGenes Randomized Study

Angeliki Papadaki, Manolis Linardakis, Thomas M. Larsen, Marleen A. van Baak, Anna Karin Lindroos, Andreas F. H. Pfeiffer, J. Alfredo Martinez, Teodora Handjieva-Darlenska, Marie Kunesová, Claus Holst, Arne Astrup, Wim H. M. Saris, Anthony Kafatos and on behalf of the DiOGenes Study Group

Pediatrics published online Oct 11, 2010;
DOI: 10.1542/peds.2009-3633





Results in Children

- The HP groups had higher protein intake (20.7±0.7 versus 17.9±0.7 %, P=0.004) than the LP groups at mo 6.
- GI was reduced 3.5 points with LGI versus HGI (P<0.001).
- **HP resulted in 2.6 cm [95% CI 0.6;4.8] (P=0.007) lower waist circumference than LP**
- **and a 0.25 mmol/L (P=0.003) lower LDL cholesterol, compared to LP.**
- **LGI vs. HGI reduced CRP (P=0.007).**
- In the supermarket centers, where intervention foods were provided to the participants, protein compliance was higher, and effects more marked (P<0.001).

Trap Damsgaard et al. J Nutr 2013

Program

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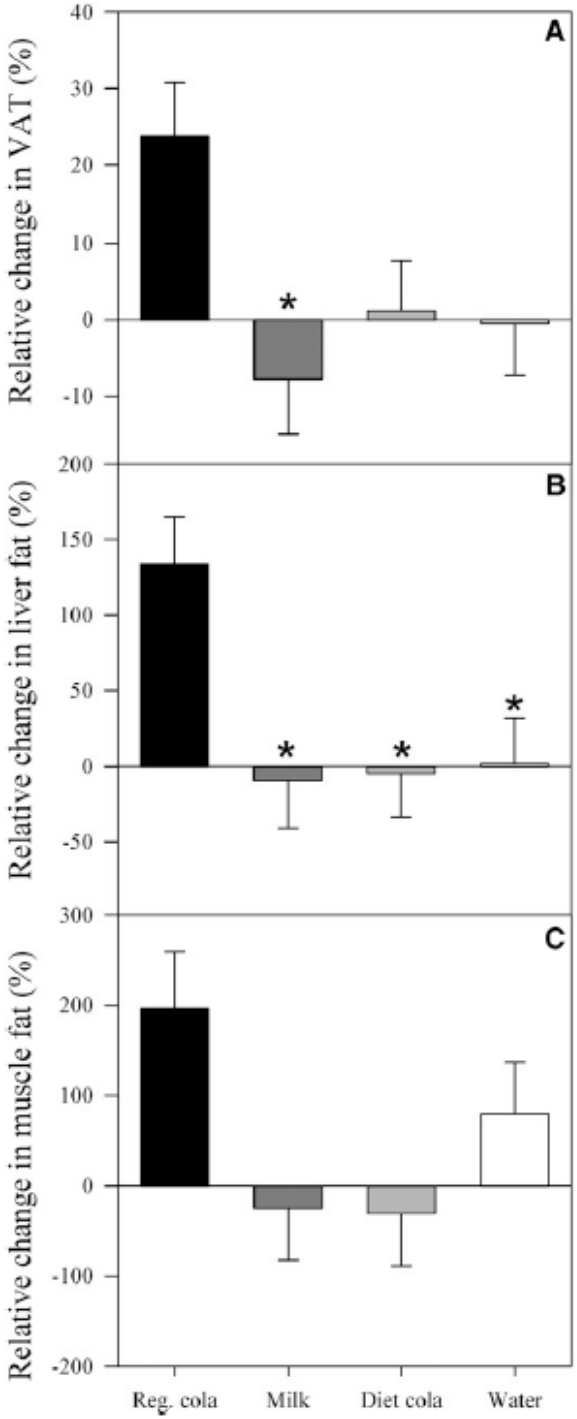
  - Observational data
  - **Randomized controlled trials - drinks**
- Mechanims linking dairy to energy balance and body composition
- Dairy and type 2 diabetes and CVD



Sucrose-sweetened beverages increase fat storage in the liver, muscle, and visceral fat depot: a 6-mo randomized intervention study[1–3]

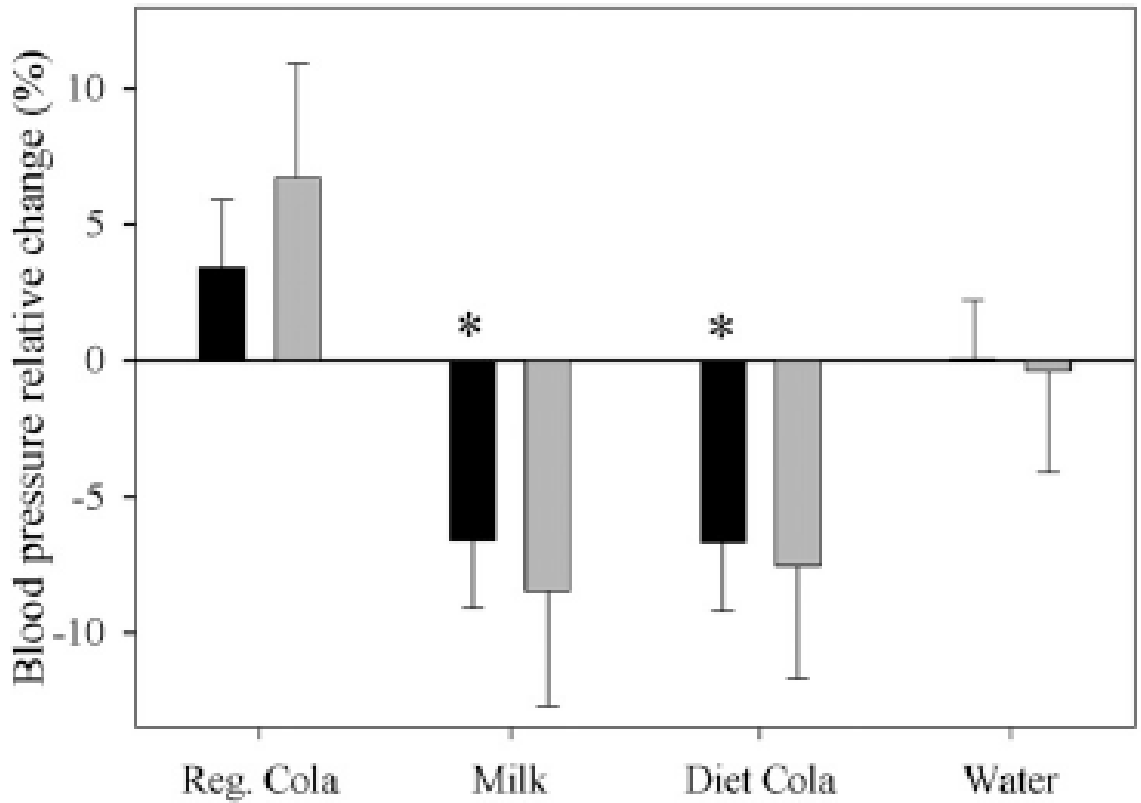
Maria Maersk, Anita Belza, Hans Stødkilde-Jørgensen, Steffen Ringgaard, Elizaveta Chabanova, Henrik Thomsen, Steen B Pedersen, Arne Astrup, and Bjørn Richelsen

ABSTRACT

Background: The consumption of sucrose-sweetened soft drinks (SSSDs) has been associated with obesity, the metabolic syndrome, and cardiovascular disorders in observational and short-term intervention studies. Too few long-term intervention studies in humans have examined the effects of soft drinks.

regular cola (11, 12). On the other hand, artificially sweetened soft drinks have also been associated with obesity and the metabolic syndrome (5, 13). However, to our knowledge, no long-term interventions (beyond 10 wk) have examined the effect of beverages on ectopic fat accumulation in humans.

Our main aim was to test the hypothesis that sucrose-sweetened



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International Journal of Obesity (2012) 1 – 9

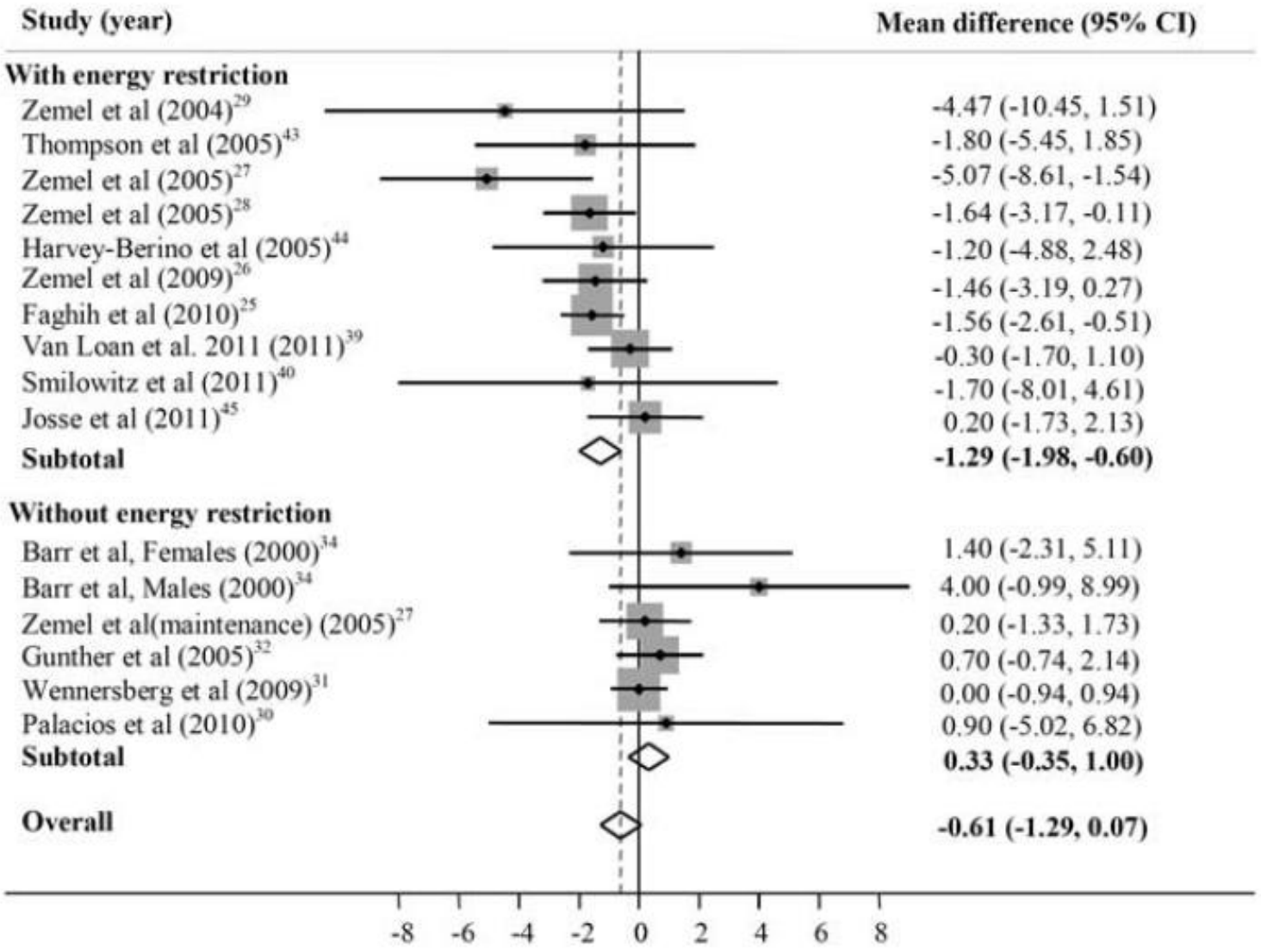
www.nature.com/ijo

ORIGINAL ARTICLE

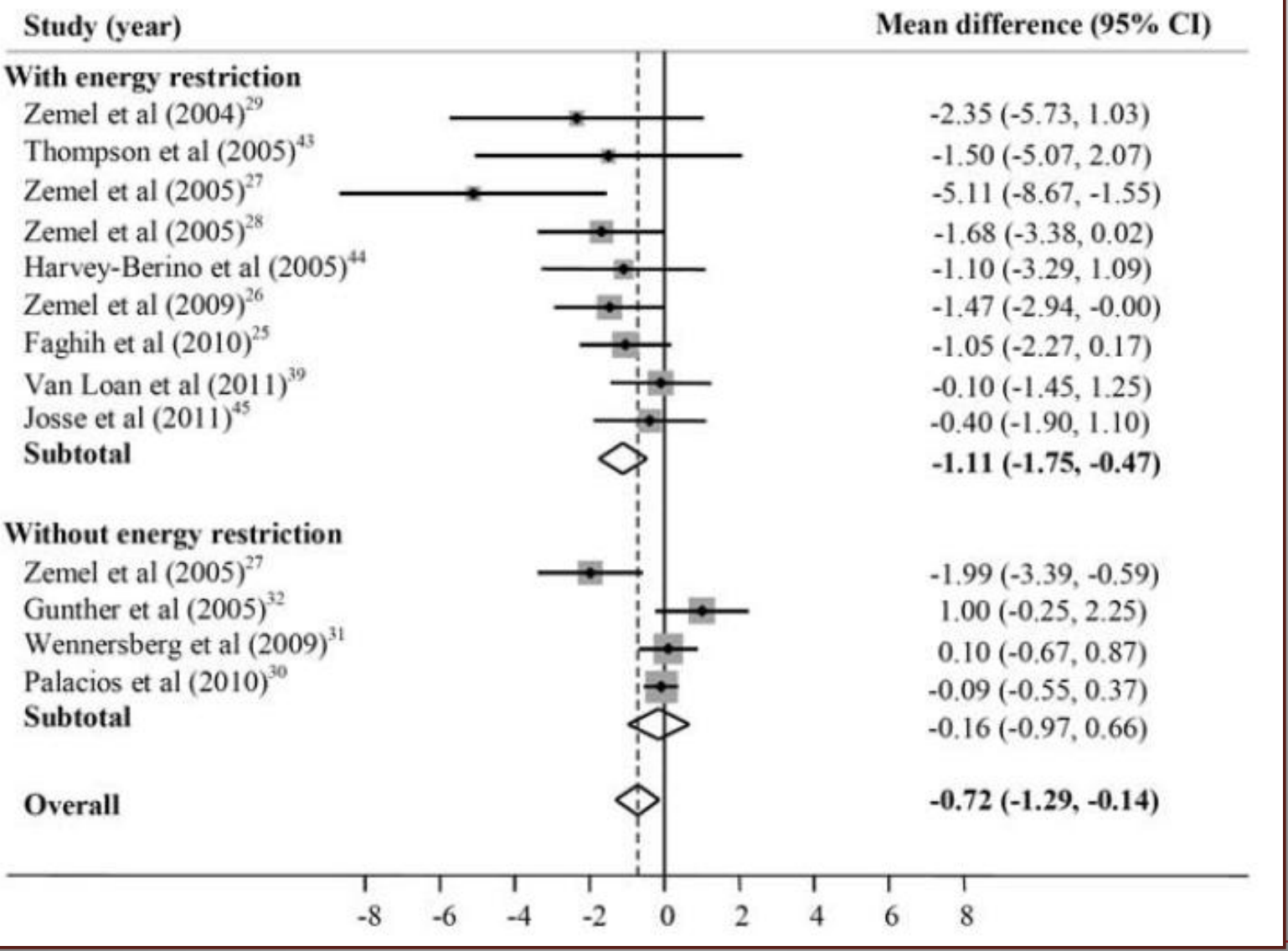
Effect of dairy consumption on weight and body composition in adults: a systematic review and meta-analysis of randomized controlled clinical trials

AS Abargouei[1,2], M Janghorbani[3], M Salehi-Marzijarani[3] and A Esmaillzadeh[1,2]

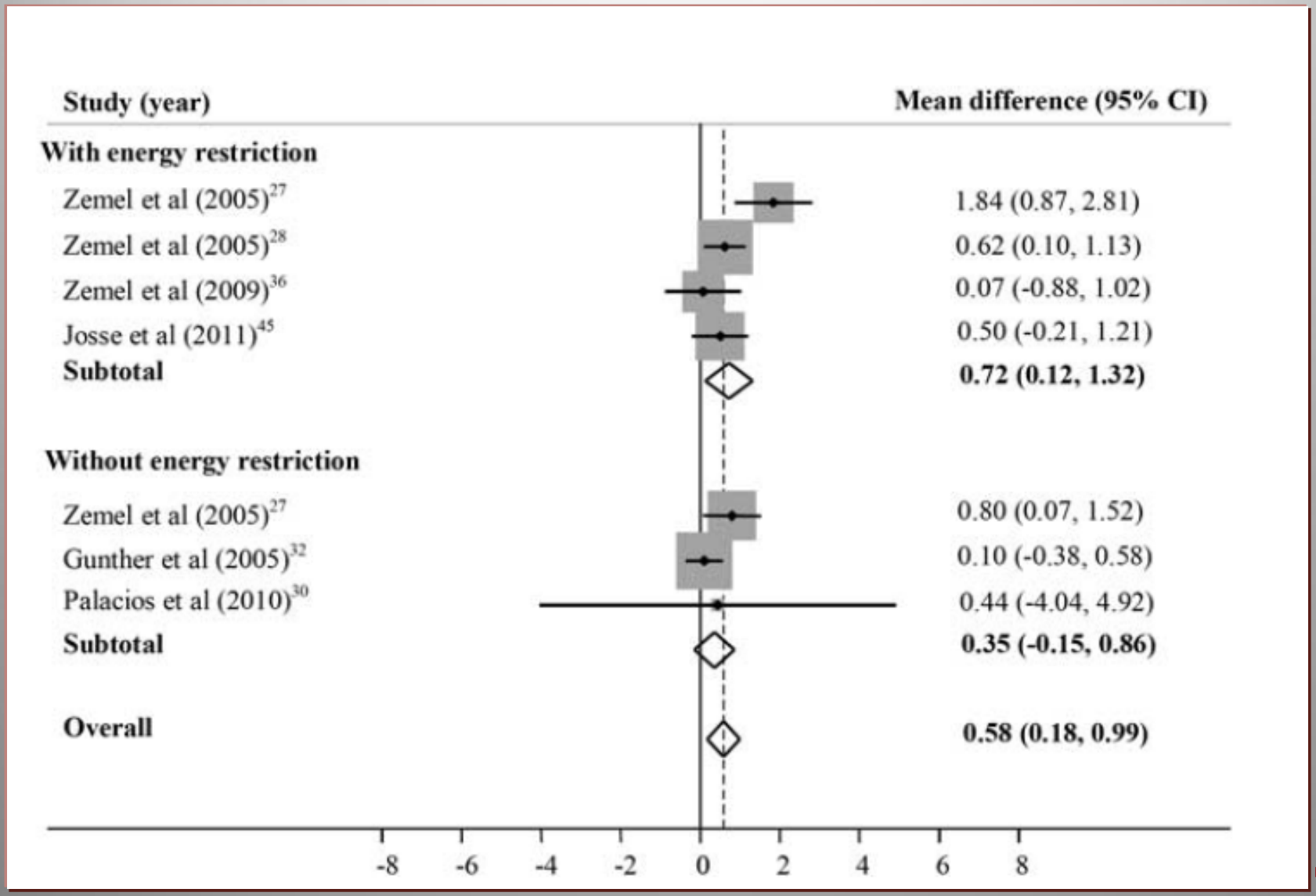
Effect of high vs low dairy on weight loss



Effect of high vs low dairy on fat loss



Effect of high vs low dairy on fat free mass



Effects of dairy intake on body weight and fat: a meta-analysis of randomized controlled trials[1–4]

Mu Chen, An Pan, Vasanti S

ABSTRACT

Background: Some intervention products may influence body we versial.

Objective: We identified and qua tion on body weight and fat mas (RCTs).

Design: We conducted a compre

sis is needed to sion of estimates eta-analysis (10) ble studies were repeatedly used. sed results, and d the statistical stimates, such as

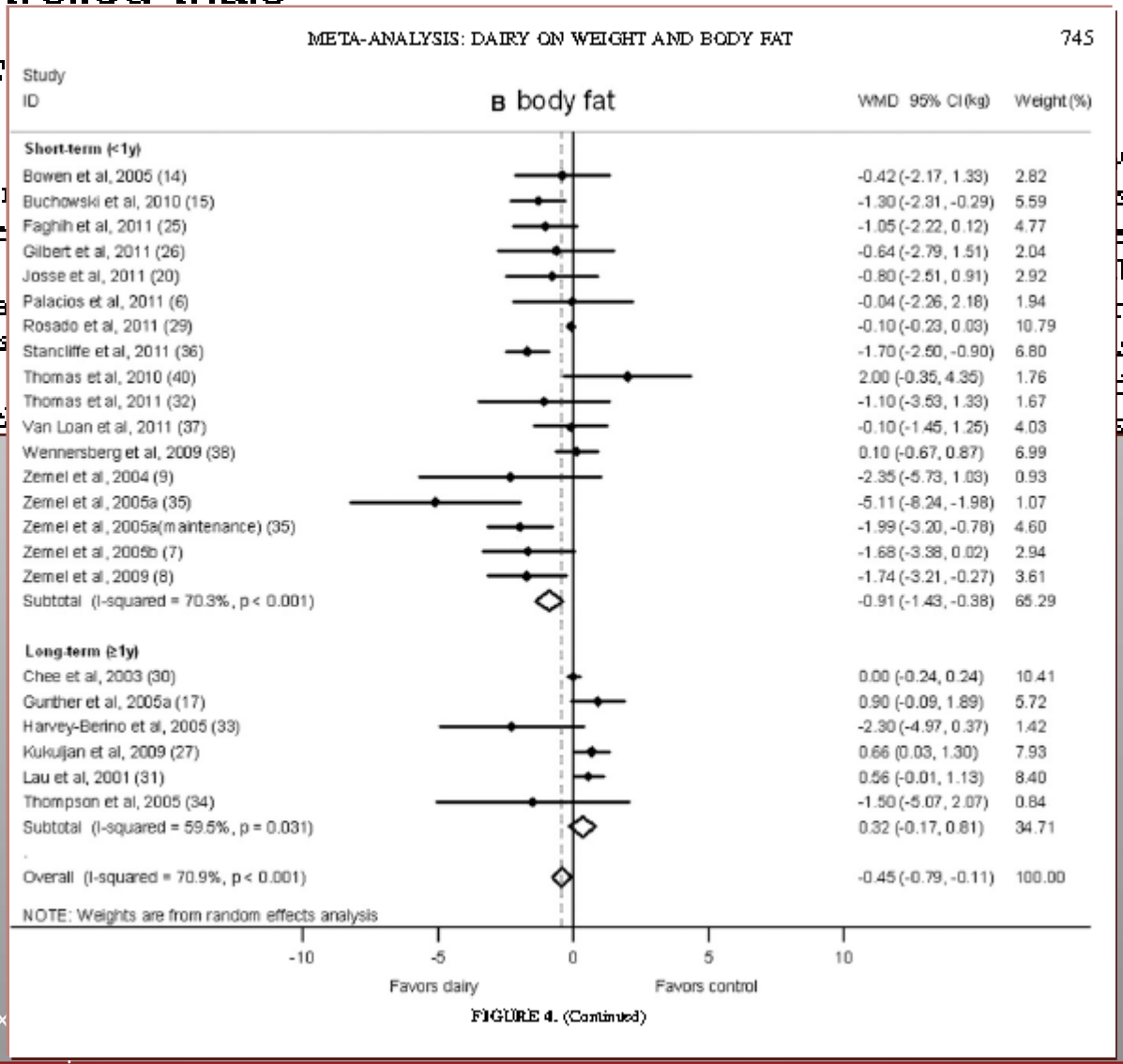


FIGURE 4. (Continued)

Dairy: Neutral on cardiometabolic risk factors

OPEN ACCESS Freely available online PLOS ONE

Effects of High and Low Fat Dairy Food on Cardio-Metabolic Risk Factors: A Meta-Analysis of Randomized Studies

Jocelyne R. Benatar*, Karishma Sidhu, Ralph A. H. Stewart

Green Lane Cardiovascular Service, Auckland City Hospital, Auckland, New Zealand

Abstract

Importance: Clear guidelines on the health effects of dairy food are important given the high prevalence of obesity, cardiovascular disease and diabetes, and increasing global consumption of dairy food.

Objective: To evaluate the effects of increased dairy food on cardio metabolic risk factors.

Program

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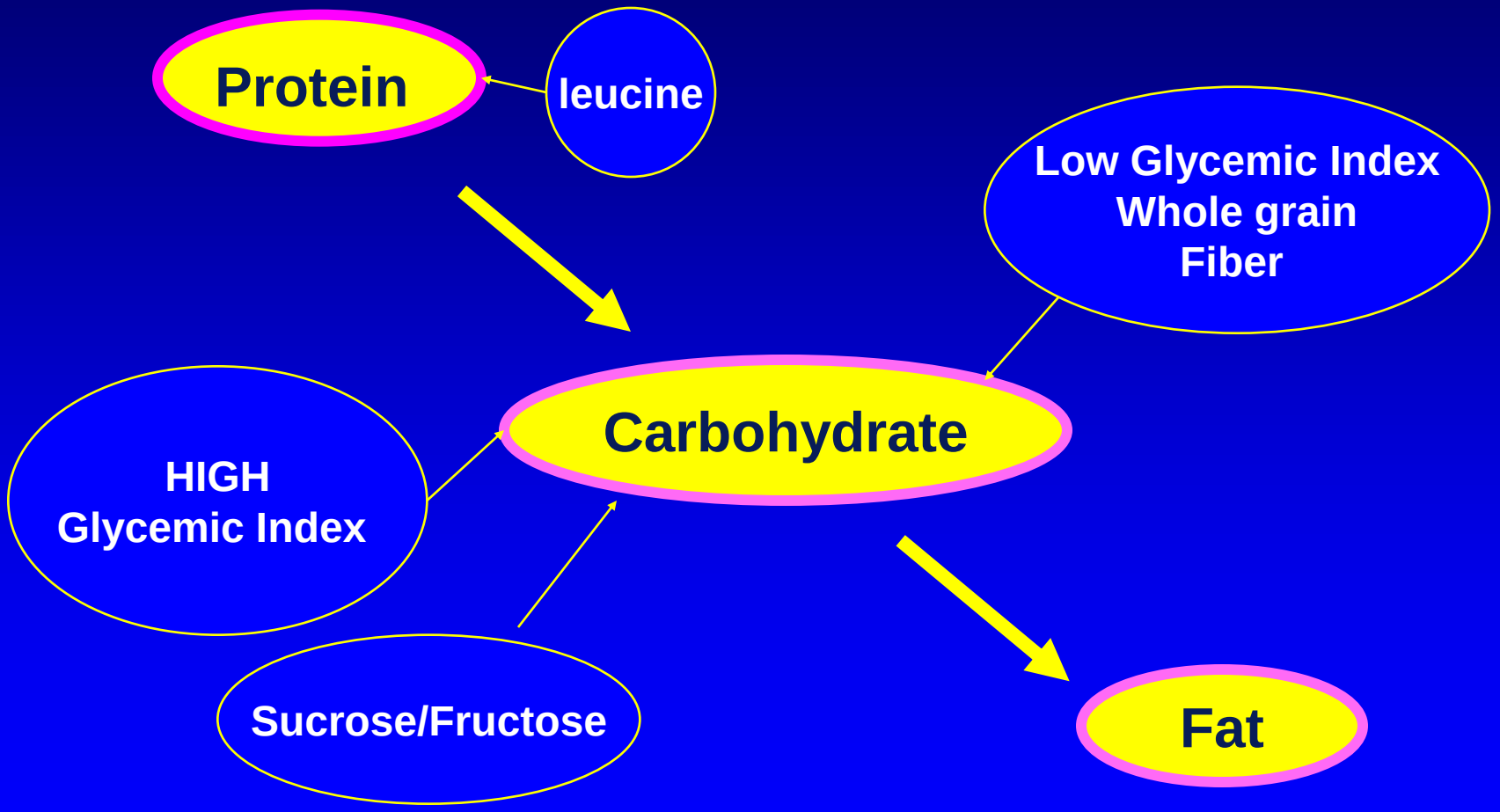
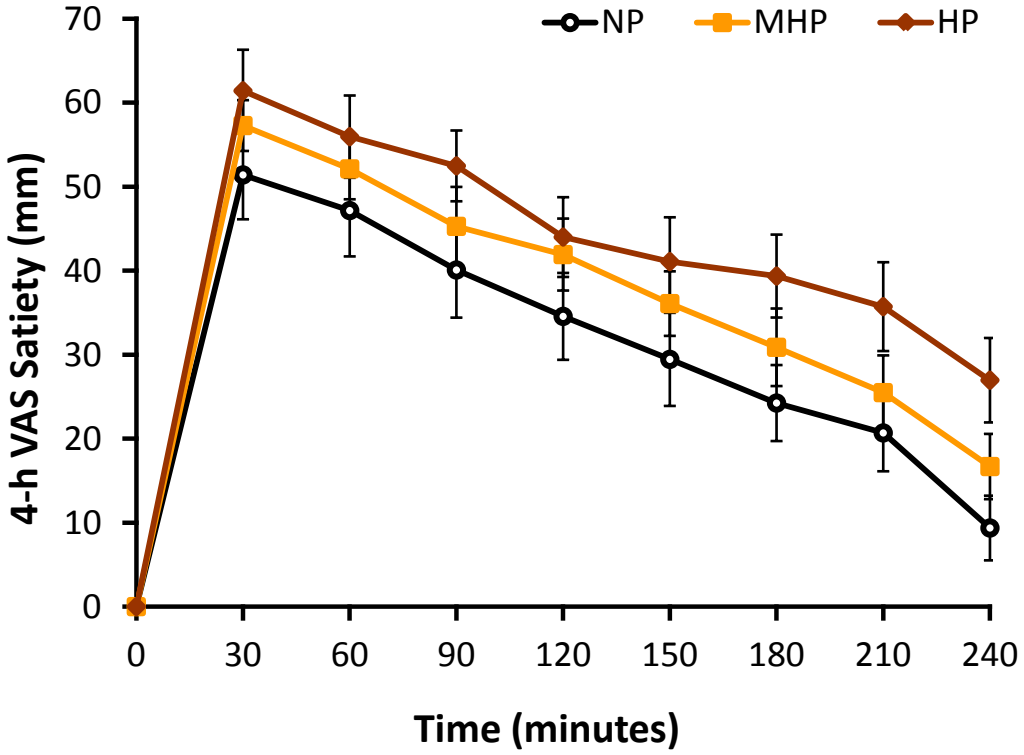
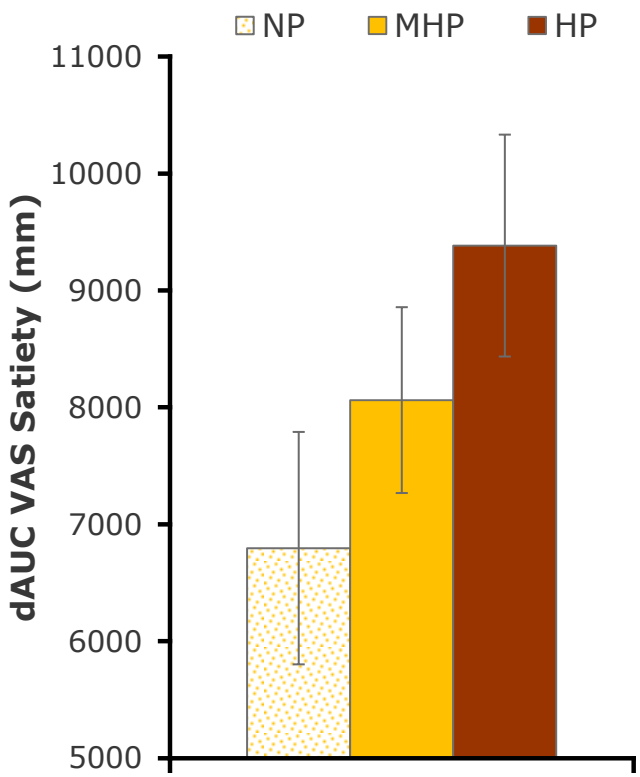
Proposed Hierarchy of Satiety



High protein, high GI

4-h dose-dependent effect on satiety





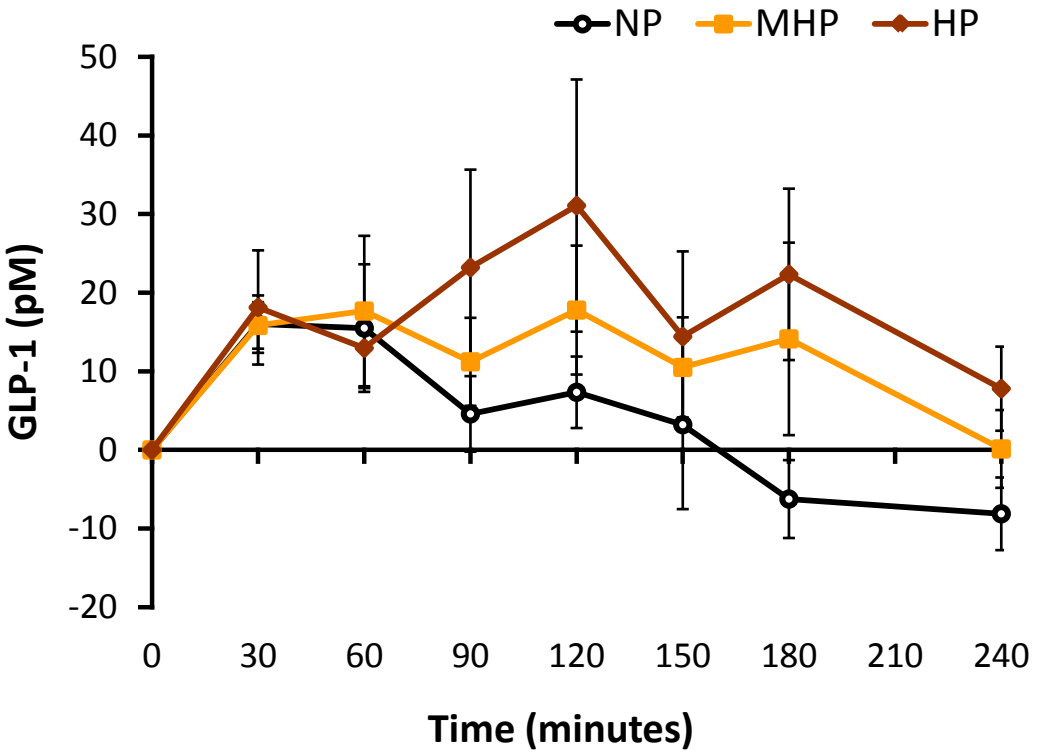
NP vs MHP: 7%, P<0.0001

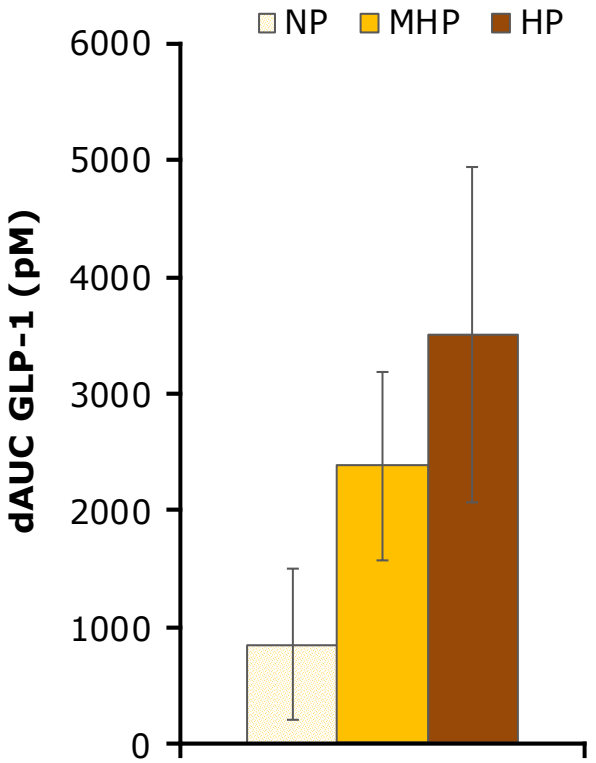
HP: 16%, P=0.001

MHP vs HP: 9%, P<0.0001

Belza et al. *Am J Clin Nutr.* 2013;363:980-9.

4-h dose-dependent effect on GLP-1





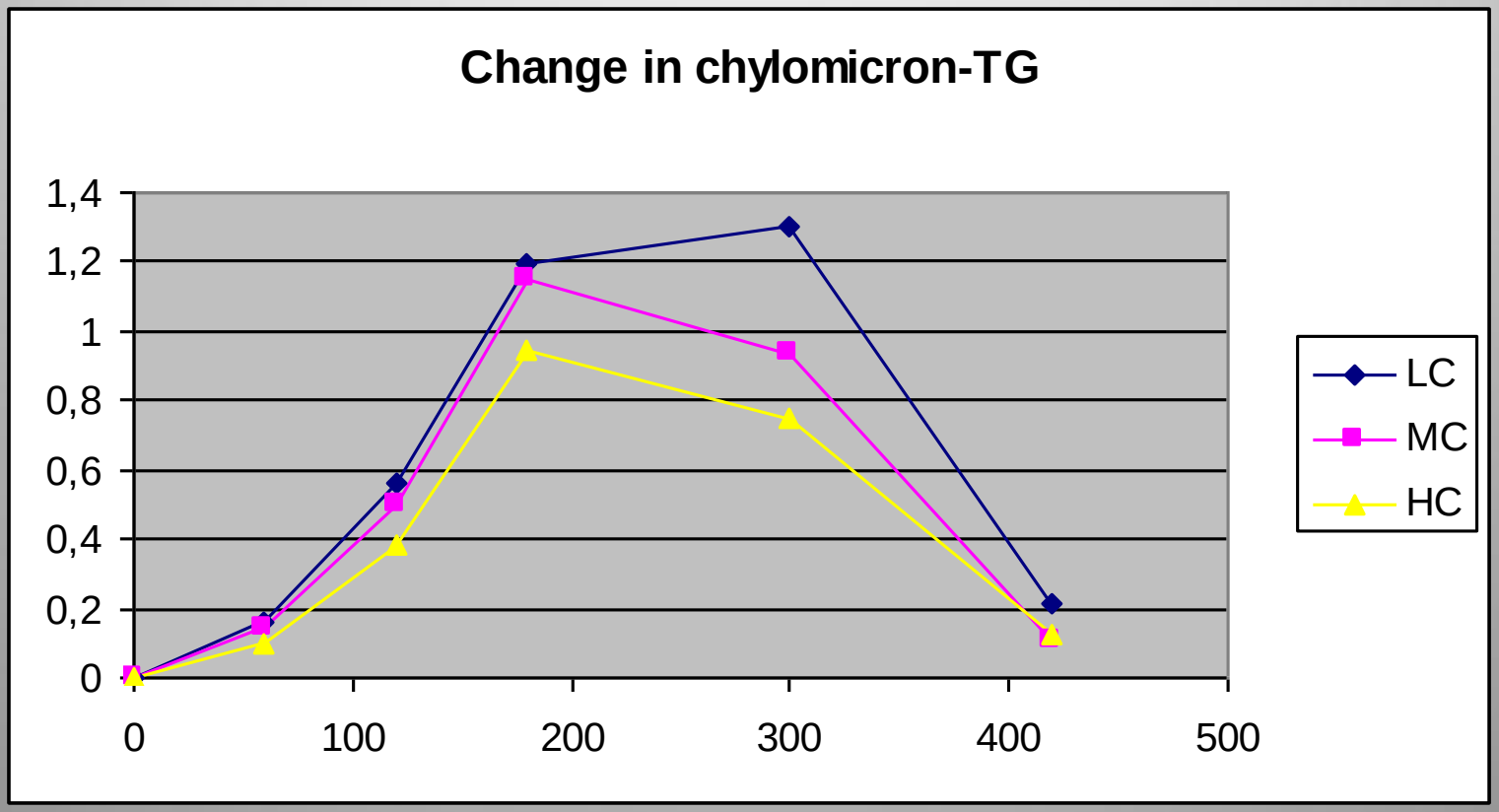
NP vs. MHP: 10%, P=0.02

HP: 20%, P<0.0001

MHP vs HP: 8%, P=0.001

Belza et al. *Am J Clin Nutr.* 2013;363:980-9.

Dairy Calcium reduces fat absorption



Lorenzen JK, Astrup A. Am. J. Clin. Nutr. (2007) n=13

AJCN. First published ahead of print March 12, 2014 as doi: 10.3945/ajcn.113.077735.

Effect of dairy calcium from cheese and milk on fecal fat excretion, blood lipids, and appetite in young men[1–3]

Karina V Soerensen, Tanja K Thorning, Arne Astrup, Mette Kristensen, and Janne K Lorenzen

Modification of effects of saturated fat by calcium

Table 1 Nutrient composition of the three diets, normalized per 10 MJ. [1]

Diet	Control	Milk	Cheese
Energy (kJ)[b]	10,007 (9,266)	10,012 (10,603)	10,006 (10,651)
Energy density (kJ/g)	5.5	5.7	5.4
Weight (g)	1,838	1,742	1,859
Fat (E%)[b]	31.7 (28.9)	31.6 (28.3)	31.5 (27.5)
SFA (g)	45.1	46.5	47.1
MUFA (g)	25.1	23	24.5
PUFA (g)	6.6	5.7	6.5
Carbohydrate (E%)	52.9	52.9	52.9
Protein (E%)	15.4	15.5	15.6
Dietary fiber (g)	19.2	20.3	18.4
Total calcium (mg)	362	1,143	1,172
Dairy calcium (mg)	0	781	810

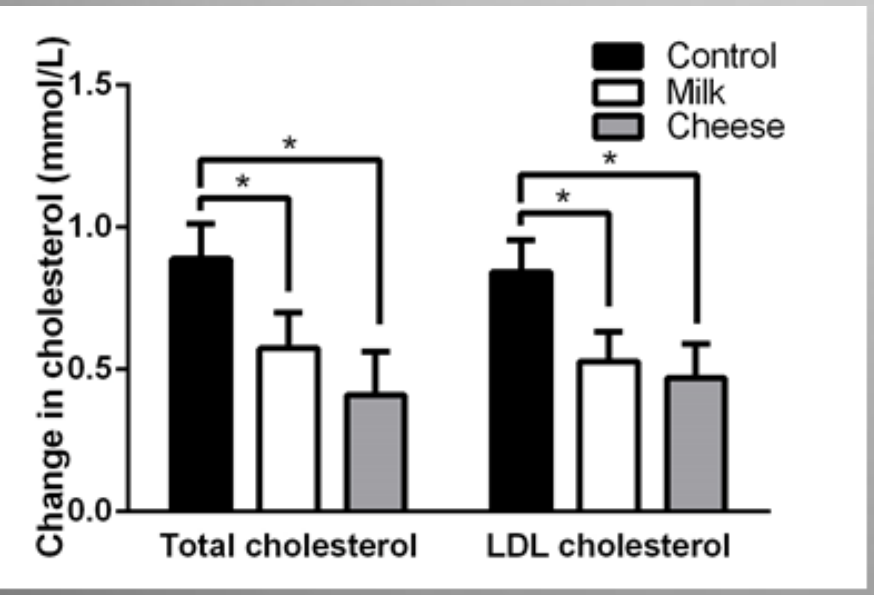
[1] The nutrient content (without water) was estimated using the Dankost 3000 dietary assessment software (Danish Catering Center, Herlev, Denmark). [b] The energy and fat contents were measured.
E%, energy percentage; SFA, saturated fatty acids; MUFA, mono unsaturated fatty acids; PUFA, poly unsaturated fatty acids.

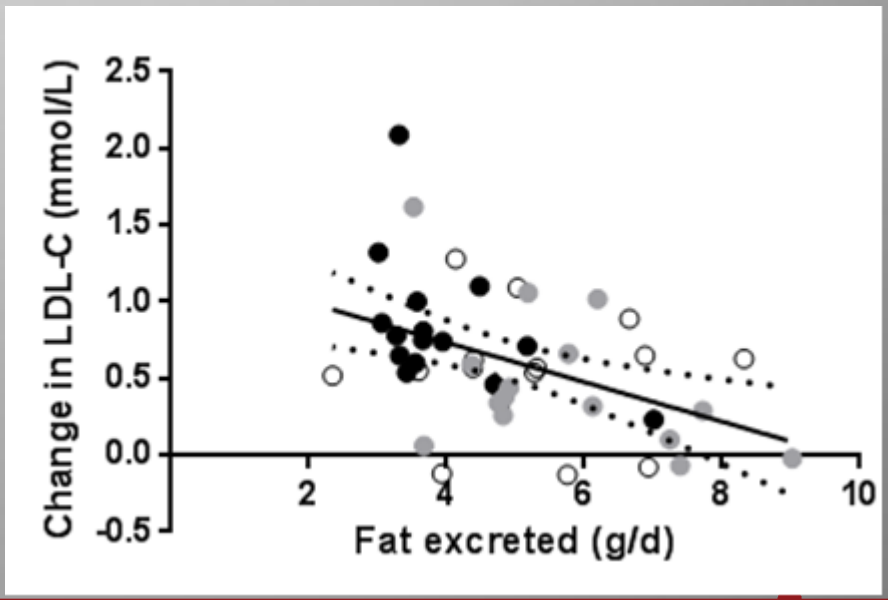
Soerensen, Thorning, Astrup, Kristensen & Lorenzen

[4]Supported by The Danish Council for Strategic Research in Health, Food and Welfare, Danish Dairy Research Foundation.

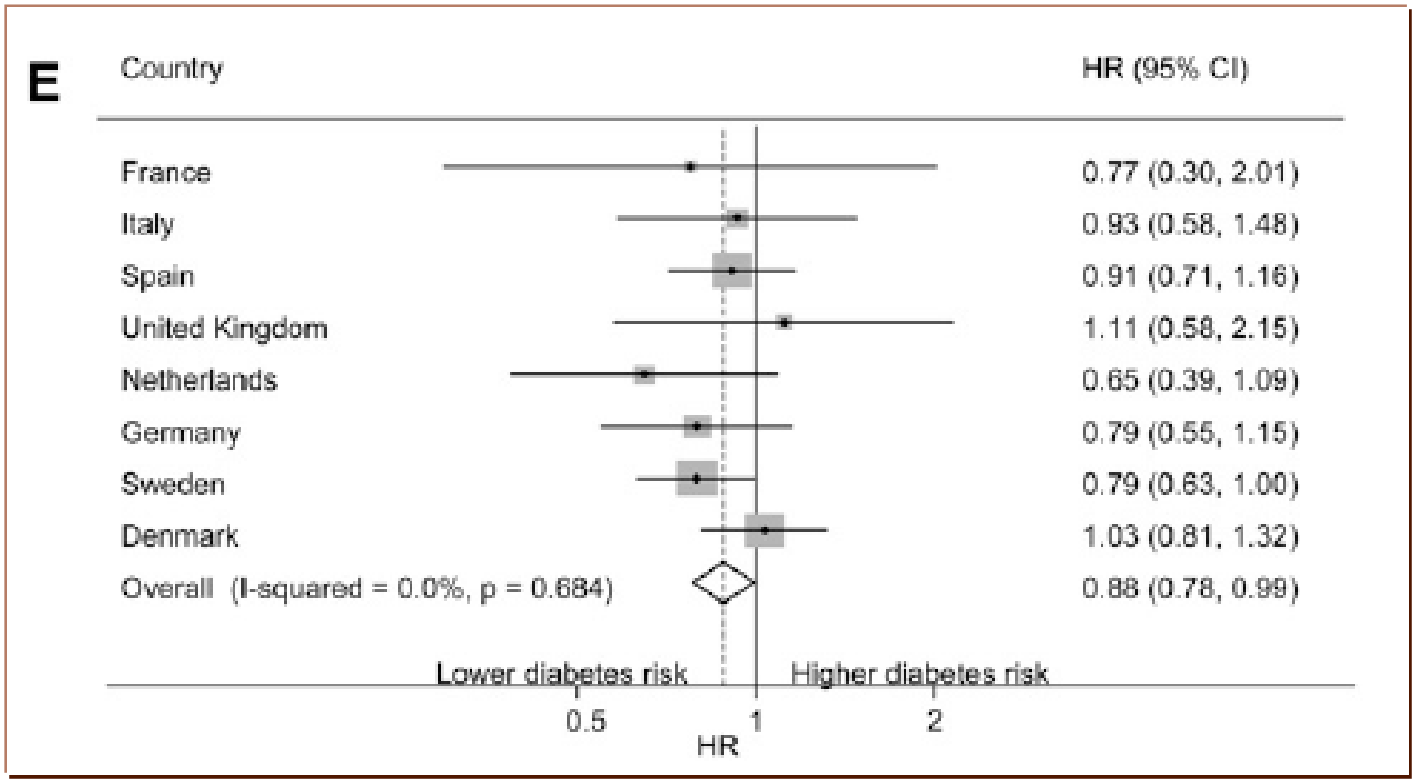
Modification of effects of saturated fat by calcium

Fecal parameters				
Excretion of DM (g/d)	34.2 ± 1.8[a]	44.6 ± 3.1[b]	40.5 ± 3.0[b]	0.002
Energy excretion (kJ/d)	712 ± 34[a]	844 ±53[b]	808 ± 60[ab]	0.032
% Energy excreted	5.3 ±0.3	5.6 ±0.3	5.4 ± 0.3	NS
Fat excreted (g/d)	3.9 ±0.3[a]	5.2 ± 0.4[b]	5.7 ± 0.4[b]	<0.001
% Fat excreted	3.8 ± 0.3[a]	4.5 ± 0.3[b]	5.1 ± 0.3[b]	0.006





Cheese intake lowers diabetes risk



Evidence based information ?

Conclusions

- Intake of dairy is inversely associated with body fat in observational studies, and there is no difference between high versus low-fat dairy
- Randomized controlled trials of dairy clearly show that dairy helps to maintain a healthy body weight and a optimal body composition i.e. preserving lean body mass and reducing fat mass.
- Milk possesses health benefits compared to sugar-rich soft drinks – both for weight control and diabetes risk.
- The beneficial effects of dairy on body weight and composition is linked to the high protein and calcium contents.
- The effect of dairy on body composition, and the positive effect of dairy fatty acid profile on T2D and CVD risks makes dairy an essential part of a healthy diet to prevent and treat obesity, sarcopenia, type 2 diabetes and cardiovascular disease.